A COMPARATIVE ANALYSIS OF MICROPLASTIC DISTRIBUTION IN SNOWFALL

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Abstract

Climate change is affecting temperatures around the world and our environment is polluted with plastics. Combining snow and microplastic observations from an urban area and forest preserve help us understand how snow, a crucial element of our climate and environmental systems, is changing and being polluted. Specifically, we want to know how much plastic there is in our snow, and the density and location of the snowpack. Scientists can study snow from space with satellites or using models but data collected on the ground is still fundamental to study what environmental impacts. Over the 2018-2019, 2019-2020 and 2020-2021 winter seasons, snow properties, meteorological data, and microplastic data were collected to analyze microplastic distribution in the snowfall in a developed plot and a remote plot.

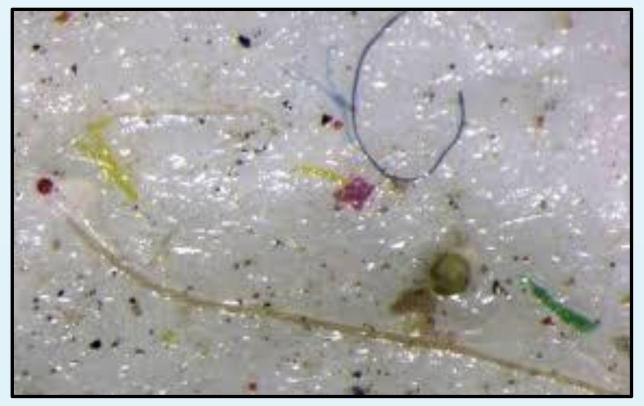
Introduction

REVIEW OF LITERATURE

- Microplastics (MP): less than 5mm in size come in many different forms (1)
- MP particles can be found in precipitation (2)
- Snowpack: Lasting snow in an area
- Snow Water Equivalent (SWE): A measure of snow density based on the water content of snow
- Atmospheric transport: movement of pollutants in the atmosphere caused by wind flow(2)

ORIGINS OF MICROPLASTICS (3)

- Synthetic microfibers from fabrics
- Degradation of macro plastics
- Rubber particulates
- Micro Fibers most common in atmospheric transport



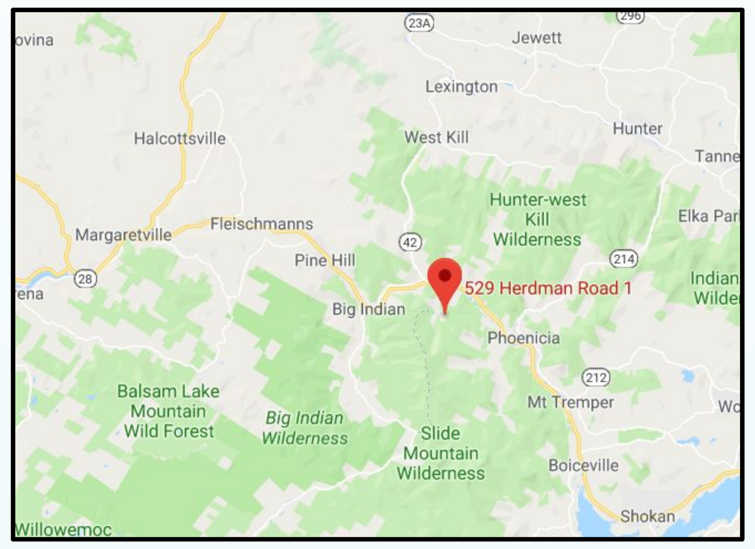
Hypothesis

Microplastic distribution will strongly correlate with snow deposition when measured in rural and urban sites.

Methodology

SITE SELECTION

- Remote site in the Catskill Mountains, NY



DRONE SPATIAL ANALYSIS

- Photographs compiled, made into a Structure From Motion (SFM) file
- Drone is flown during times of snow cover and bare ground
- SFM models overlayed to determine snow depth

SNOW DATA

- Not disturbing snow was of utmost priority
- Collected in Zig-Zag pattern
- SWE measurements collected
- Depth data was recorded with metric ruler and GPS device

METEOROLOGICAL DATA

- Historical and current wind speed and direction
- Frequency and severity of precipitation
- Air Temperature and Humidity were recorded

Results

METEOROLOGICAL DATA

- Data from early 2019 highlights the unpredictability of weather
- Vast meteorological difference recorded between Sites
- Extreme temperature fluctuation at urban site

Summary
February 1, 2019 - February 28, 2019

	High	Low	Average
Temperature	32.7 °F	25.0 °F	29.2 °F
Dew Point	29.8 °F	20.1 °F	24.4 °F
Humidity	93 %	76 %	82 %

	High	Low	Average
Wind Speed	11.4 mph	0.0 mph	1.6 mph
Wind Gust	14.8 mph	--	2.3 mph
Wind Direction	--	--	South

Summary
February 1, 2019 - February 28, 2019

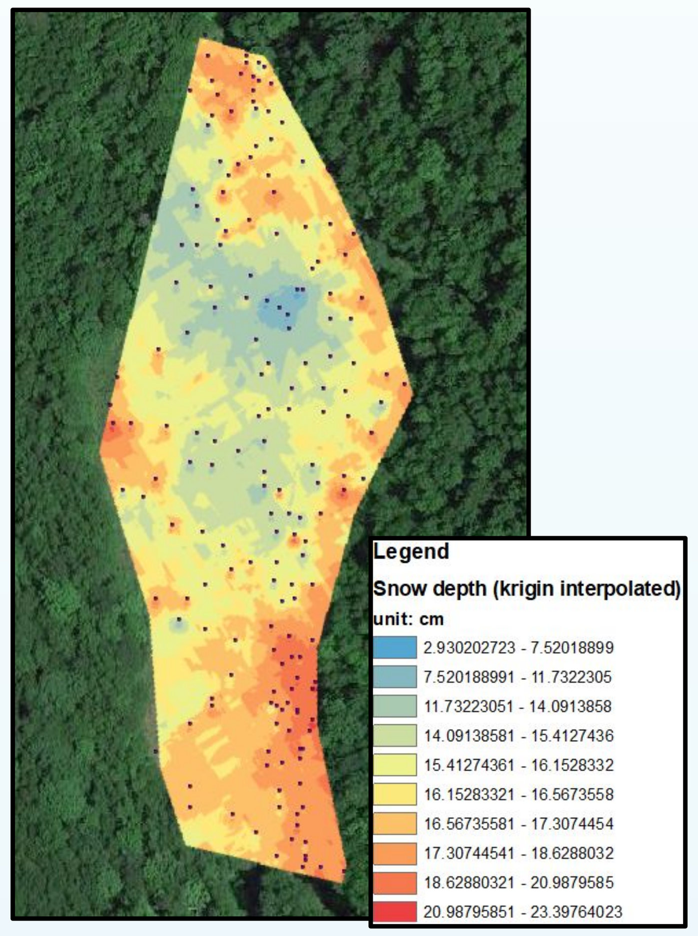
	High	Low	Average
Temperature	62.4 °F	-8.0 °F	29.8 °F
Dew Point	45.9 °F	-13.9 °F	20.5 °F
Humidity	97 %	30 %	70 %

	High	Low	Average
Wind Speed	28.0 mph	0.0 mph	2.9 mph
Wind Gust	34.0 mph	--	5.3 mph
Wind Direction	--	--	South

Results

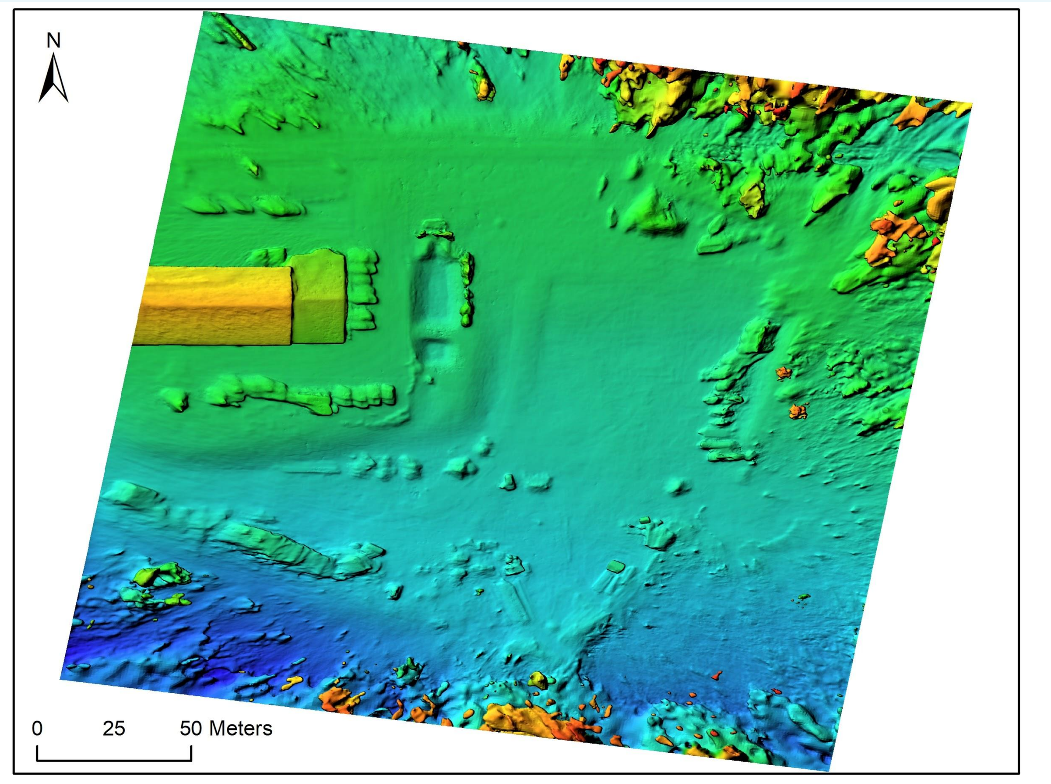
SNOW DATA

- February 6th 2019 snow condition data was collected from the remote and urban sites
- Variability in snow depth likely results from the topographic variability and wind redistribution

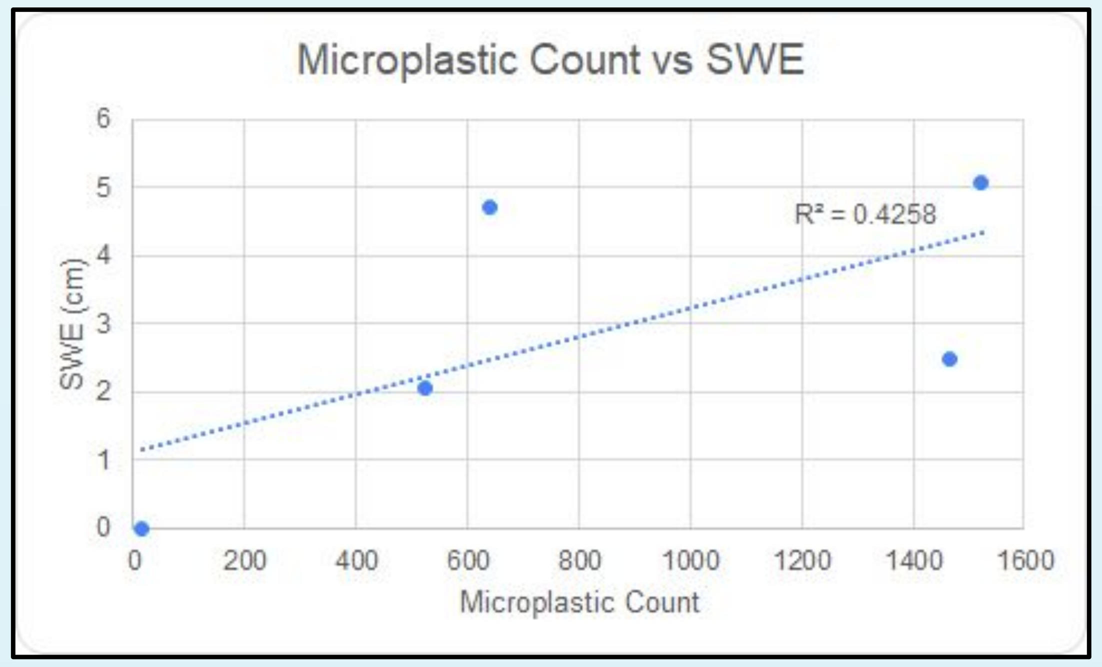


DRONE SPATIAL ANALYSIS

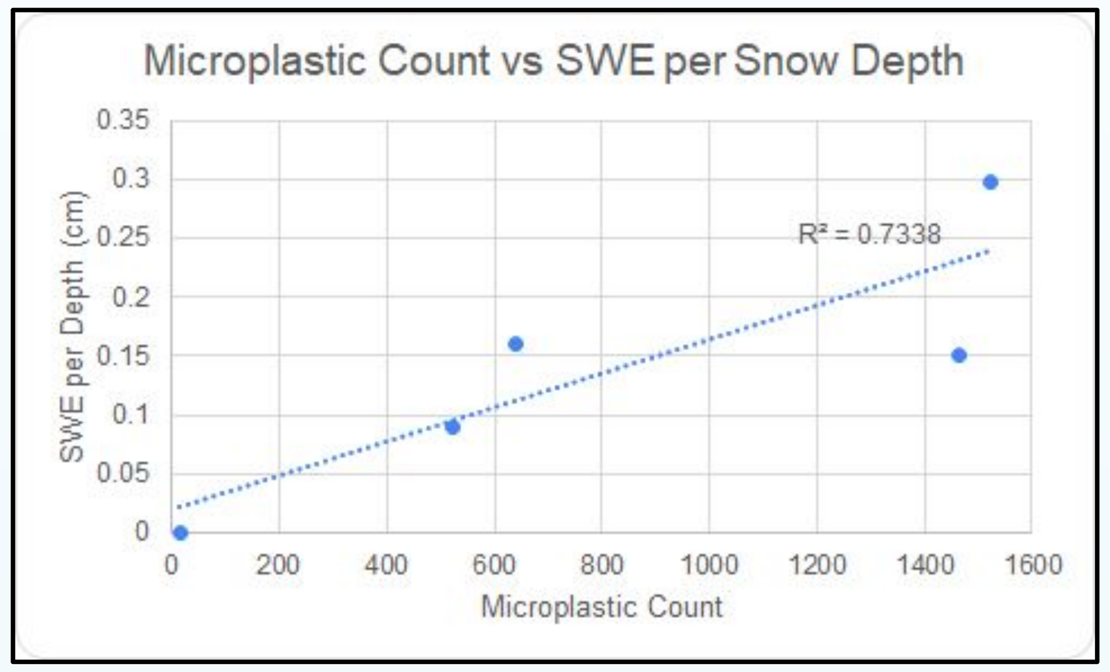
- Used to validate the snow depth data
- Photographs were processed using the PhotoScan software to produce a SFM of the field site



MICROPLASTIC DATA

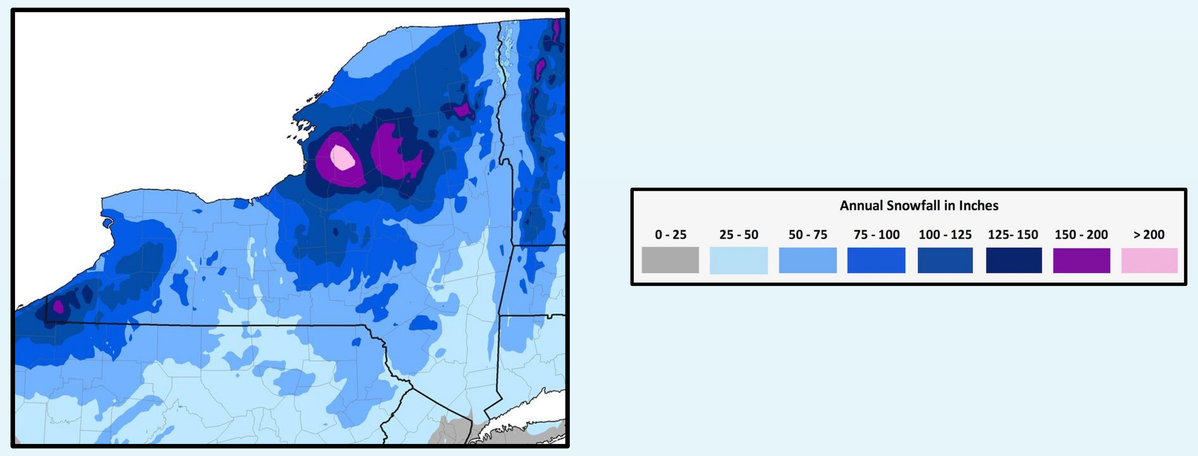


The correlation between Microplastic count and SWE is 0.4258.



Microplastic count vs SWE per Snow Depth was a more accurate predictor of MP distribution with a Correlation of 0.7338

- Variability in snow depth results from topographic variability, wind redistribution
- New York State 2019-2020 winter snowfall at new record low
- Extreme temperature fluctuation makes it very difficult for a sustainable snowpack to develop
- Similar wind patterns aid in MP distribution
- Snow depth and SWE can be a predictor for distribution of MP particles due to large scale atmospheric transport and deposition
- There is strong evidence MP distribution correlates with snow deposition and SWE



Work Cited

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